Design and synthesis of chemosensors for the selective detection and quantification of some important biomolecules and metal ions in water

Introduction:

Fluorescent chemosensor is a research area of significant importance in molecular recognition. They are used to detect an analyte through a highly selective and usually irreversible/reversible chemical reaction between the probe and the target analyte. Interestingly, chemosensors provide an ideal way to design fluorescence "turn-on" probes for the quenching of the target molcules and it provides signaling changes in both the absorption wavelength and color. The field of reaction-based sensors is still in its infancy. So, in our approach the development of new and selective chemosensors for biomolecules, we have designed variety of synthetic fluoroionophores which will be close to maximize the binding interactions toward the analyte over other competing one. By introducing reactive centre into the binding site of the fluoroionophore, the resulting fluoroionophore probes that sense analytes through chemical reactions, which is usefulness for achieving high selectivity of analyte than supramolecular approach. We will use various types of biocompatible fluorophores such as rhodamine, coumarin, carbazole, fluorescein etc. as well as we will introduce different reactive functionalities around the binding zones depending on the biomoleculeor the reactant substrates for studying protocols of chemosensors. We will also be trying to explore these sensors in the biological and environmental fields.

Originof the proposal

The concept of molecular recognition is fundamentally important both in chemistry and biology. The specific recognition process is responsible for many chemical, biological and material properties of large and small molecules. One of the main research areas in the field of supramolecular chemistry is the development of sensors for biomolecules present in cell. The dtection of biomolecules has been a major research focus in science and technology for many decades given its myriad application in molecular diagnosis, environmental monitoring, drug discovery and biological warefare.

Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids, xanthine alkaloids etc. These biomolecules interact with each other and constitute the molecular logic of life processes.Fluorescent small molecules that respond to biomolecules in the cell with appropriate selectivity and sensitivity offer the ability to probe physiological and pathological consequences of the cell biology of biomolecules with spatial and temporal fidelity. Molecular imaging of normal and abnormal cell pools using these new chemical tools provides a host of emerging opportunities for visualizing, in real time, aspects of metal accumulation, trafficking, and function or toxicity in living

systems. There has been considerable interest in the development of facile and reliable methods to detect nucleic acids owing to their potential applications in bioanalytical, clinical, and forensic analysis. The methods based on fluorescent sensors offer distinct advantages in terms of sensitivity, selectivity, response time, local observation (e.g. by fluorescence imaging spectroscopy). Therefore, considerable efforts are being made to develop selective fluorescent sensors for biomolecule detection and quantification. The design and synthesis of model receptors to recognize substrates of biochemical significance to mimic biological events is an important area in molecular recognition research. The ability of biosensing molecules to selectively monitor guest species in living cells is of great importance for biological application. Thus hydrogen bonding is the favorite intermolecular force because of its directionality, specificity and biological relevance. In particular, the detection and quantification of biologically relevant molecules *in vitro* and *in vivo* using chemosensors has become of critical importance in the modern chemical and biochemical research in abroad and in India.

The project aims to synthesize functionalized water soluble chemosensors which have been incorporated into a large variety of biomolecule sensor for nucleotides and their analogs followed by subsequent bioassay and/or bio-imaging for the same. DNA nucleobase recognition by small molecules has received much attention for functional sensor design and anticancer drug screening, and because of their susceptibility to cause various common diseases. Additionally, organic probes possessing hydrogen bond moieties that are complementary to the target bases, such as naphthyridine, pyrazine, lumazine, pteridine, and flavin derivatives, can recognize DNA nucleobases. These label-free and cost-effective fluorescence strategies are particularly attractive for DNA nucleobase recognition and other promising applications such as aptamer sensor designs. This proposal will examine NTP's(Nucleoside Triphosphates) structural components, diverse biological properties, and therapeutic consequences, including cytotoxic compounds, antiviral agents, and immunosuppressive molecules. Moreover, it will try to conclude the pharmaceutical and diagnostic applications of NTP modification and how fluorescent labeled receptors provide sensitive probes for studying the structure, dynamics, and interactions nucleotide analogs.

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